

Appendix A

Data in Support of Risk Assessment

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A.1. Determination of Background for Metals and Radiological Substances in Surface Soil, Subsurface Soil, and Ground Water

As part of the baseline human health assessment conducted for the Site Wide Remedial Investigation (SWRI), background values for metals and radiological substances were determined in surface soil, subsurface soil, and ground water using data collected through the end of December 1991 (Webster-Scholten, 1994). These background values were presented in Chapter 4 of the SWRI report, with supporting data presented in Appendix P. However, to evaluate data collected subsequent to 1991 for potential inclusion as a chemical of concern for the purposes of developing remedial alternatives, it was necessary to update the background evaluation to include the more recent data. Our reevaluation of these background values is presented below.

A.1.1. Background Concentrations and Activities in Surface Soil

As was done in the SWRI report, background for metals and radiological substances in surface soil (soil from 0 to 0.5 ft in depth) was determined using the method of Michels (1971). This method uses log-probability plots to reveal whether a set of data is described by a single distribution or multiple distributions. When more than one distribution is observed in these plots, it is presumed to be indicative of heterogeneity of the data (i.e., a separate source is associated with each distribution). Our initial assumption when multiple distributions are observed in the data is that distributions with higher concentrations/activities are indicative of contamination. However, this may not always be the case, and may be reflective of natural heterogeneity in the rock/soil types from which the samples were obtained. But we must have additional geologic information supporting an interpretation of natural heterogeneity before discarding the default assumption of contamination associated with multiple data distributions.

Log-probability plots were constructed using data collected across the site that had been received and validated by October 28, 1998. All Environmental Restoration Division data were used, as were surface soil monitoring data collected by LLNL's Operations and Regulatory Affairs Division. A total of 17 metals and 8 radiological substances were evaluated. Table A-1 summarizes the results of the metals evaluation, and Table A-2 summarizes the results of the radiological evaluation. Log-probability plots are available upon request.

From our evaluation of the log-probability plots, we concluded that there is no evidence of surface soil contamination at Site 300 with antimony, arsenic, barium, chromium, cobalt, mercury, molybdenum, nickel, vanadium, radium-226, or thorium-230. The surface soil data for silver were extremely limited (fewer than 10 detections of each metal), and thus we concluded that our data were not adequate to determine whether silver is present at levels indicative of background or contamination. Thallium was not detected in any surface soil sample.

The presence of multiple data distributions was apparent for beryllium, cadmium, copper, lead, zinc, radium-228, thorium-228, thorium-232, uranium-234, uranium-235, and uranium-238. Nineteen samples showed evidence of potential beryllium contamination, all but one of these samples came from the Building 812 area (the other sample came from the Building 850 area). Over seventy samples showed evidence of potential cadmium contamination, these samples were located throughout the site (Buildings 850, 840, 841, 854, 836, 827, 801, 834, 815, and 818). More than fifty samples showed evidence of potential copper contamination. These samples were also scattered across the site at Buildings 801, 850, 832, 851, 830, 812, and 854. Approximately twenty samples showed evidence of potential lead contamination, located near Buildings 801, 830, 854, and 812. The highest concentrations were clustered around Building 812. Over forty samples showed evidence of potential zinc contamination. These samples were located near Buildings 840, 830, 854, 880, 841, 851, and 812. Metals in these areas were evaluated in the contaminant of concern (COC) screening process to determine which metals were COCs in surface soil in specific operable units as described in Chapter 1.

Of the radiological substances, thorium-232 and radium-228 each had a single sample obtained from the Building 812 area with activity higher than expected for a single data distribution. Three samples had activity of thorium-228 higher than expected for a single distribution. Two of these samples also came from the Building 812 area. Activity in the third sample, from borehole 823-07, may be related to the naturally high uranium activities in the area (see discussion on the natural occurrences of uranium at Site 300 below). Four samples contained activity of uranium-234 higher than expected. Three of these samples were obtained from the Building 812 area, the fourth (sample 3-167-SO) came from the area south of Building 851. Fifteen samples contained uranium-235 activities suggestive of potential contamination. These samples were obtained near Buildings 851, 812, 850, 801 and 854. Uranium-238 data resolved into four distinct distributions, reflecting a complex source distribution. While the vast majority of the data plotted within the presumed "background" distribution, nearly seventy samples plotted within the higher three distributions. The highest distribution, with activities ranging from 39 to 461 pCi/g, fall almost exclusively within the Building 812 area. However, samples collected near Building 851, 850, and 801 also fall within these upper distributions.

As can also be observed from Table A-1 and A-2, with the exception of arsenic, thorium-228, uranium-235, and uranium-238, surface soil concentrations did not exceed the industrial Preliminary Remediation Goals (PRGs), regardless of the presence of contamination. In the case of arsenic, although our data do not show evidence of contamination, our background concentrations exceed PRGs. Arsenic is recognized by the U.S. EPA as a metal that may have background concentrations that exceed risk based PRGs (U.S. EPA, 1998). Generally, the U.S. EPA does not require clean up below natural background (U.S. EPA, 1998). In addition to arsenic, background levels of thorium-228 at Site 300 also exceed PRGs.

A.1.2. Background Concentrations and Activities in Subsurface Soil

As described above for surface soil, background concentrations and activities of metals and radiological substances were evaluated using the method of Michels (1971). For the present evaluation, we used all data collected below a depth of 0.5 ft. This differs from the method presented in the SWRI report, where we evaluated only data collected from between a depth of 0.5

to 12 ft. We evaluated all depths as we are interested in what substances could potentially reach the underlying ground water, where as in the SWRI report, we were focusing on substances which could cause an ecological exposure.

Log-probability plots were constructed using data collected across the site that had been received and validated by October 28, 1998. All Environmental Restoration Division data were used. A total of 14 metals and 10 radiological substances were evaluated. Table A-3 summarizes the results of the metals evaluation, and Table A-4 summarizes the results of the radiological evaluation. Log-probability plots are available upon request.

From our evaluation of the log-probability plots, we concluded that there is no evidence of subsurface soil contamination at Site 300 with beryllium, molybdenum, nickel, thallium, vanadium, bismuth-214, lead-212, lead-214, potassium-40, radium-226, or thorium-232. The presence of multiple data distributions was observed in the data for arsenic, barium, cadmium, chromium, cobalt, copper, mercury, selenium, zinc, thorium-232, uranium-234, uranium-235, and uranium-238. However, for many of the metals, the second distribution was comprised of only one to a few samples. Three samples had arsenic levels higher than expected. Two samples were collected from the Building 832 Canyon area, and one sample was collected from the Building 834 area. Eight samples had cadmium concentrations which plotted in the highest concentration distribution. The eight samples were collected from the Building 840/841 area and the Building 832 Canyon area. A single sample collected from the vicinity of Building 833 contained chromium concentrations higher than expected from the data distribution. Six samples contained cobalt concentrations slightly higher than expected from the data distribution. These samples were collected from the Building 832 Canyon area and near the vicinity of Building 807. Metals and radioisotopes in these areas were evaluated in the COC screening process to determine which constituents were COCs in subsurface soil in specific OUs as described in Chapter 1.

Twenty-two samples, all collected from the Building 850 area, contained thorium-232 activities higher than predicted from the data distribution. Nine samples contained uranium-234 activities somewhat lower than predicted from the data distribution. Two of these samples came from the Building 851 area, with the remaining samples collected from the Building 850 area. Ten samples contained uranium-235 activities higher than expected. Three samples each were located in the Building 850 and 854 areas, two samples located in the HE process area, and one sample each located in the vicinity of Buildings 814 and 851. Ten samples also contained uranium-238 activities higher than predicted from the data distribution. Five samples were located in the Building 850 area, three samples were located in the HE Process area, and two were located in the Building 851 area. However, to make a definitive determination that these distributions are representative of contamination, the isotopic ratios must be evaluated for the presence of natural, depleted or enriched ratios. This evaluation is presented below in Section A.1.4.

A.1.3. Background Concentrations and Activities in Ground Water and Surface Water

During the Site Wide Remedial Investigation, background concentrations and activities of metals and radiological substances in ground water and surface water were determined through an evaluation of wells and springs identified as being hydrologically isolated from suspected areas of contamination. These wells and springs were listed in Table 4-17 in the SWRI report (Webster-

Scholten, 1994). The apparent background concentration ranges for metals and radiological substances were listed in Table 4-18 in the SWRI report.

As additional data have been collected from these background locations subsequent to the SWRI data-cut off of December 31, 1991, we have resummarized the data from these locations in Table A-5. We have included two values for nitrate, one value obtained from a ground water well, a second value obtained from a spring. The reason for including two values stems from the fact that springs are important water sources for resident animal populations at Site 300, particularly deer. Waste from these animals can easily contaminate these water sources. In addition, such contamination can appear transitory, depending upon when the sample was collected with respect to the most recent use by the animals. Thus, surface waters can sporadically have very high concentrations of nitrate, as can be observed in Table A-5. The same cannot be said for nitrite, however, as any nitrite in surface water will readily oxidize to nitrate.

A.1.4. Occurrences of Depleted Uranium at Site 300

This section summarizes uranium 235/uranium 238 (U235/U238) mass ratio data for Site 300 surface soil, subsurface soil, springs, and ground water samples collected and analyzed before the September 1998 SWFS data cutoff. These data provide a basis for distinguishing anthropogenically-derived depleted uranium (mass ratio <0.007) from natural uranium (mass ratio approximately equal to 0.00711), which is a constituent of the Neroly Formation. Based on the available data, all the depleted uranium results occur in the Building 850/Pits 3 & 5 (OU5), Building 854 (OU6), and the Building 801, 812, 851, and Pit 2 areas (OU8).

A.1.4.1. Surface Soil

A total of 63 surface soil (<0.5 ft bgs) samples were collected and analyzed by mass spectrometer to determine U235/U238 mass ratio. U235/U238 mass ratio results range from 0.00189 to 0.00729; depleted uranium is present in 59 of the 63 surface soil samples. A data summary by OU is presented in Table A-6. Table A-7 presents data from each sample location.

Forty six of the 49 surface soil samples collected in the Building 850/Pits 3 & 5 (OU5), eight of the nine samples collected in the Building 854 Area (OU6), and all five samples collected in OU8 contain depleted uranium. Three of the OU8 samples are located in the vicinity of Building 801 and the other samples are located in Elk Ravine, south of Building 812. No surface soil U235/U238 mass ratio data exist for Building 834 (OU2), Pit 6 (OU3), HE Process Area (OU4) or Building 832 Canyon (OU 7).

A.1.4.2. Subsurface Soil and Bedrock

A total of 86 subsurface soil and bedrock (≥ 0.5 ft bgs) samples were collected from 17 boreholes and analyzed by mass spectrometer to determine U235/U238 mass ratio. These samples range in depth from 0.5 to 513.5 ft bgs; U235/U238 results range from 0.00294 to 0.00758. Depleted uranium is present in 11 of the 86 subsurface soil and bedrock samples and six out of 17 boreholes. A data summary by OU is presented in Table A-8. Table A-9 presents data from each borehole, including number of analyses, range of sample depths, and sample results.

Ten of the 54 subsurface soil and bedrock samples collected in Building 850/Pits 3 & 5 OU (OU5) contain depleted uranium. These 10 samples range in depth from 10 to 43 ft bgs and were collected from five boreholes located near Pits 3 and 5. Of the four samples collected in the W-854-01 borehole located in Building 854 (OU6), one sample (collected from 0.5 ft bgs) contains depleted uranium. All of the subsurface samples collected in the three HE Process Area (OU4) boreholes contain U235/U238 mass ratios indicative of natural uranium. These samples were collected at depths ranging from 80 to 367 ft bgs. The subsurface samples collected in borehole K9-02, located near Pit 9 (OU8), also contain U235/U238 mass ratios indicative of natural uranium. These samples range in depth from 142.5 to 167.5 ft bgs. No subsurface soil U235/U238 mass ratio data exist for Building 834 (OU2), Pit 6 (OU3), or Building 832 Canyon (OU7).

A.1.4.3. Ground Water and Springs

A total of 427 ground water samples were collected from 114 ground water monitoring wells and three springs and analyzed by mass spectrometer to determine U235/U238 mass ratio. U235/U238 mass ratio results range from 0.00267 to 0.00816. Depleted uranium is present in 33 of the 104 monitoring wells and two of the three springs. A data summary by OU is presented in Table A-10. Table A-11 summarizes data from each sampling location, including number of analyses, range of results, and average result for each sampling location.

Depleted uranium is present in 119 of 287 ground water samples collected from 66 sampling locations in the Building 850/Pits 3 & 5 (OU5). Based on U235/U238 mass ratio averages from each sampling location, 20 monitoring wells and one spring (Well 8 Spring) in OU5 contain depleted uranium. Depleted uranium is present in 26 of 110 ground water samples collected from 34 sampling locations in OU8. Based on U235/U238 mass ratio averages from each sampling location in OU8, four monitoring wells (three located near Building 851 and one located near Pit 2) and one spring (Spring 6) contain depleted uranium. Of the eight monitoring wells sampled in the Building 854 area (OU6), only W-854-05 contains depleted uranium. All 22 ground water samples from eight monitoring wells and one spring (Spring 3) in the Pit 6 (OU3), HE Process Area (OU4), and Building 832 Canyon (OU7) contain U235/U238 mass ratios indicative of natural uranium. No ground water U235/U238 mass ratio data exist for Building 834 (OU2).

A-2. References

- Michels, D. E. (1971), "Log-normal analysis of data for plutonium in the outdoors," in Proceedings of Environmental Plutonium Symposium, held at LASL, August 4–5, 1971, Los Alamos National Laboratory, Los Alamos, N. Mex. (LA-756), pp. 105-111.
- U.S. EPA (1998), Region 9 Preliminary Remediation Goals (PRGs) 1998. May 1, 1998. From <http://www.epa.gov/region09/waste/sfund/prg/intro.htm> on November 16, 1998.
- Webster-Scholten, C. P., Ed. (1994), *Final Site-Wide Remedial Investigation Report, Lawrence Livermore National Laboratory Site 300*, Lawrence Livermore National Laboratory, Livermore, Calif. (UCRL-AR-108131).

Table A-1. Maximum and background concentrations of metal elements in surface soil at Site 300.

Compound	Site 300 maximum (mg/kg)	Revised maximum background ^a (mg/kg)	Industrial PRG (mg/kg)	PRG basis
Antimony and compounds	4.0	4.0	750	nc
Arsenic	16.0	16.0	3.0	ca
			22.0	nc
Barium and compounds	540	540	100,000	max
			5,200 ^b	
Beryllium and compounds	260	2.5	3,400	nc
Cadmium and compounds	28	1.9	930	nc
Chromium	122	122	450 (1/6 Cr VI)	ca
			64 (Cr VI)	ca
			0.2 ^c	ca
Cobalt	36	36	29,000	nc
Copper and compounds	1,800	39	70,000	nc
Lead	510	51	1,000	nc
			130 ^c	
Mercury and compounds	0.29	0.29	560	nc
Molybdenum	15	15	9,400	nc
Nickel	110	110	37,000	nc
(soluble salts)			150 ^c	
Selenium	2.4	0.96	9,400	nc
Silver and compounds	42	Not determinable ^d	9,400	nc
Thallium	<5 (nominal)	Not determinable ^d	various 150-170	nc
Vanadium	220	220	13,000	nc
Zinc	1,400	110	100,000	max
			22,000 ^c	nc

Notes:**PRG = Preliminary Remediation Goal.****nc = Non-carcinogen.****ca = Carcinogen.**^a **Background values revised by the creation of new log probability plots.**^b **Residential.**^c **California modified residential.**^d **Not determinable due to less than 10 positive detections.**

Table A-2. Maximum and background concentrations of radiologic parameters in surface soil at Site 300.

Radionuclide	Maximum Site 300 revised background ^a				PRG basis
	Site 300 maximum (pCi/g)	(pCi/g)	Industrial PRG (pCi/g)		
Radium 226	1.32	1.32	5.6		ca
Radium 228	1.88	1.36	13		ca
Thorium 228	3.78	1.56	.15		ca
Thorium 230	2.29	2.29	80		ca
Thorium 232	2.20	1.50	92		ca
Tritium	1.68	300 pCi/L _{sm}	–		–
Uranium 234	27.3	3.54	69		ca
Uranium 235	3.0	0.0737	0.57		ca
Uranium 238	461	3.1	73		ca

Notes:**PRG = Preliminary Remediation Goal.****ca = Carcinogen.**

^a Maximum revised background concentration determined through creation of new log probability plots for surface soil.

Table A-3. Maximum and background concentrations of selected metal elements in subsurface soil (all depths below 0.5 ft) at Site 300.

Compound	Site 300 maximum (mg/kg)	Maximum Site 300 revised background ^a (mg/kg)
Arsenic	37.0	8.3
Barium and compounds	1100	560
Beryllium and compounds	1.4	1.4
Cadmium and compounds	15	1.5
Chromium	200	78
Cobalt	30	19
Copper and compounds	180	66
Mercury and compounds	1.4	0.20
Molybdenum	27	27
Nickel (soluble salts)	140	140
Selenium	10.0	1.5
Thallium	14.0	14.0
Vanadium	130	130
Zinc	2,200	91

^a Background values revised by the creation of new log probability plots.

Table A-4. Maximum and background concentrations of selected radiologic parameters in subsurface soil (all depths below 0.5 ft) at Site 300.

Radionuclide	Site 300 maximum (pCi/g)	Maximum Site 300 revised background ^a (pCi/g)
Bismuth 214	1.67	1.67
Lead 212	1.56	1.56
Lead 214	1.08	1.08
Potassium 40	21.60	21.60
Radium 226	1.04	1.04
Thallium 208	0.50	0.50
Thorium 232	3.20	1.30
Tritium	1180.994	300 pCi/L _{sm}
Uranium 234	3.7	1.80
Uranium 235	0.5	0.094
Uranium 238	28.2	1.9

^a Background values revised by the creation of new log probability plots.

Table A-5. Background concentrations ranges or activities for metals, ions, and radiologic parameters in wells and springs at Site 300.

Constituent	Well/spring with highest reported concentration	Minimum concentration	Maximum concentration	Minimum LOD	Maximum LOD	Units
Aluminum	Spring 2	1.2	1.3	0.2	0.2	mg/L
Antimony	W-806-06A	0.007	0.007	0.06	0.1	mg/L
Arsenic	W-806-06A	0.002	0.22	0.002	0.005	mg/L
Barium	Spring 2	0.004	0.29	0.025	0.1	mg/L
Beryllium	Spring 2	0.0003	0.004	0.0001	0.01	mg/L
Cadmium	Spring 17	0.0001	0.0015	0.0001	0.04	mg/L
Chromium	Spring 2	0.001	0.026	0.001	0.05	mg/L
Cobalt	W-806-06A	0.001	0.001	0.03	0.05	mg/L
Copper	W-806-06A	0.0059	0.05	0.01	0.08	mg/L
Fluoride	Spring 2	0.28	0.76	^a	^a	mg/L
Iron	W-25N-07	0.03	3.8	0.03	0.1	mg/L
Lead	Spring 2	0.002	0.02	0.001	0.3	mg/L
Magnesium	W-6ES	0.26	102	0.5	0.5	mg/L
Manganese	Spring 2	0.01	0.77	0.01	0.05	mg/L
Mercury	Spring 12	0.0018	0.0018	0.0001	0.001	mg/L
Molybdenum	W-873-01	0.046	0.057	0.025	0.1	mg/L
Nickel	W-806-06A	0.021	0.021	0.03	0.1	mg/L
Nitrate (as NO ₃) ^b	Spring 16	0.5	4600	0.4	22.15	mg/L
Nitrate (as NO ₃) ^c	W-808-01	0.4	91	0.4	2.5	mg/L
Nitrite (as N)	W-806-06A	0.01	0.01	0.01	5	mg/L
Nitrite (as NO ₂)		ND	ND	0.07	5	mg/L
Selenium	W-806-06A	0.002	0.033	0.001	0.005	mg/L
Silver	W-806-06A	0.0004	0.0004	0.001	0.05	mg/L
Thallium		ND	ND	0.001	0.2	mg/L
Tritium	NC7-13	ND	7,810,000	0.176	591,000	pCi/L
Uranium 234 and Uranium 233	Spring 16	0.25	13	0.1	0.2	pCi/L
Uranium 235 and Uranium 236	Spring 16	0.037	1.79	0.018	0.17	pCi/L
Uranium 238	Spring 16	0.12	9.28	0.1	0.2	pCi/L
Vanadium	W-806-06A	0.17	0.17	0.03	0.2	mg/L
Zinc	Spring 17	0.01	0.12	0.01	0.05	mg/L

Notes:

LOD = Limit of detection.

ND = Non-detections for these samples.

^a All samples had positive detections.^b Nitrate background for surface water.^c Nitrate background for ground water.

Table A-6. Summary of sampling events and occurrences of uranium-235/uranium-238 in surface soil (<0.5 ft bgs) at Site 300.

Operable unit (OU)	Total number of analyses	Number of analyses less than 0.007	Range of values
Building 834 (OU 2)	No data	No data	No data
Pit 6 Area (OU 3)	No data	No data	No data
HE Process Area (OU 4)	No data	No data	No data
Building 850/Pits 3 & 5 (OU 5)	49	46	0.00189 - 0.00729
Building 854 Area (OU 6)	9	8	0.00409 - 0.00726
Building 832 Canyon (OU 7)	No data	No data	No data
OU 8	5	5	0.0025 - 0.00478
Totals	63	59	

Note:

ft bgs = Feet below ground surface.

Table A-7. Summary of uranium-235/uranium-238 in surface soil (<0.5 ft bgs) at Site 300

Operable Unit (OU)	Sampling location	Result ^a	Error (+/-)
Building 850/Pits 3 & 5 (OU5)	3SS-01-02	0.00718	0.00022
	3SS-02-02	0.00685	0.00013
	3SS-04-03	0.005935	0.00011
	3SS-04-04	0.00601	0.00008
	3SS-05-02	0.00345	0.00012
	3SS-06-02	0.00534	0.00012
	3SS-06-03	0.00438	0.00015
	3SS-850-100	0.0029	0.000055
	3SS-850-101	0.00238	0.00005
	3SS-850-102	0.0027	0.00007
	3SS-850-103	0.0022	0.00026
	3SS-850-104	0.003355	0.00011
	3SS-850-105	0.00245	0.00005
	3SS-850-106	0.00252	0.00005
	3SS-850-107	0.00189	0.00003
	3SS-850-108	0.00624	0.0002
	3SS-850-109	0.00656	0.00024
	3SS-850-110	0.005475	0.00025
	3SS-850-111	0.00371	0.00012
	3SS-850-112	0.00382	0.00009
	3SS-850-113	0.00234	0.00007
	3SS-850-114	0.00277	0.00023
	3SS-850-115	0.00464	0.00021
	3SS-850-116	0.00516	0.00032
	3SS-850-117	0.00287	0.00015
	3SS-850-118	0.00361	0.0002
	3SS-850-119	0.00436	0.0002
	3SS-850-120	0.00282	0.00009
	3SS-850-121	0.00294	0.0001
	3SS-850-122	0.00355	0.0002
	3SS-850-123	0.00639	0.00038
	3SS-850-124	0.00491	0.00039
	3SS-850-125	0.00574	0.00026
	3SS-850-126	0.00288	0.00025

**Table A-7. Summary of uranium-235/uranium-238 in surface soil (<0.5 ft bgs) at Site 300
(Cont. Page 2 of 2)**

Operable Unit (OU)	Sampling location	Result ^a	Error (+/-)
Building 850/Pits 3 & 5 (OU5) (Cont.)	3SS-850-127	0.0037	0.00018
	3SS-850-128	0.00729	0.00012
	3SS-850-129	0.00322	0.00027
	3SS-850-130A	0.00287	0.000225
	3SS-850-131A	0.00382	0.00025
	PIT7-01	0.00623	0.0001
	PIT7-04	0.00565	0.00006
	PIT7-05	0.00258	0.00005
	PIT7-06	0.00705	0.00013
	PIT7-07	0.00224	0.00004
	PIT7-08	0.00627	0.00009
	PIT7-09	0.00597	0.0001
	W-PIT7-02	0.00602	0.0001
	W-PIT7-03	0.00196	0.00003
	W-PIT7-10	0.00637	0.0002
Building 854 (OU6)	3SS-56-05	0.00504	0.00012
	3SS-854-021	0.00409	0.00007
	3SS-854-022	0.00726	0.00019
	3SS-854-025	0.00566	0.00014
	3SS-854-026	0.00665	0.00013
	3SS-854-027	0.00556	0.00008
	3SS-854-028	0.00594	0.00012
	3SS-854-029	0.005855	0.000135
	3SS-854-030	0.00472	0.000095
Building 801 (OU8)	3SS-12-02	0.00478	0.00012
	3SS-12-03	0.00373	0.00012
Other (OU8)	3SS-13-02	0.0025	0.00008
	3SS-15-02	0.004375	0.00012
	3SS-15-03	0.00396	0.00012

Note:**ft bgs = Feet below ground surface.**^a Shading indicates values less than 0.007.

Table A-8. Summary of sampling events and occurrences of uranium-235/uranium-238 in subsurface soil (>0.5 ft bgs) at Site 300.

Operable unit (OU)	Total number of analyses	Number of analyses less than 0.007	Number of sampling locations (boreholes)	Number of sampling locations (boreholes) with analyses less than 0.007	Range of values
Building 834 (OU 2)	No data	No data	No data	No data	No data
Pit 6 Area (OU 3)	No data	No data	No data	No data	No data
HE Process Area (OU 4)	18	0	3	0	0.00712 - 0.00758
Building 850/Pits 3 & 5 (OU 5)	54	10	12	5	0.00294 - 0.00752
Building 854 Area (OU 6)	4	1	1	1	0.00568 - 0.00757
Building 832 Canyon (OU 7)	No data	No data	No data	No data	No data
OU 8	10	0	1	0	0.00713 - 0.00752
Totals	86	11	17	6	

Note:

ft bgs = Feet below ground surface.

Table A-9. Summary of uranium-235/uranium-238 in subsurface soil (>0.5 ft bgs) at Site 300.

Operable unit (OU)	Sampling location	Sample depth range (ft bgs)	Result ^a	Error (+/-)
HE Process Area (OU 4)	W-814-04	221.5	0.00734	0.000255
	W-814-04	250.5	0.00739	0.000285
	W-827-05	115.5	0.00749	0.000335
	W-827-05	135.9	0.00727	0.000145
	W-827-05	238	0.00727	0.000200
	W-827-05	301.5	0.00726	0.000250
	W-827-05	367	0.00738	0.000320
	W-829-06	80.5	0.00735	0.000150
Building 850/Pits 3 & 5 (OU 5)	NC7-44	35.5	0.00747	0.000180
	NC7-74	35.5	0.00728	0.000290
	NC7-74	46	0.00732	0.000370
	NC7-74	87	0.00723	0.000235
	NC7-74	101.5	0.00745	0.000400
	NC7-74	184.5	0.00726	0.000345
	NC7-74	271.5	0.00723	0.000210
	NC7-74	322.5	0.00716	0.000350
	NC7-74	357.5	0.00710	0.000510
	NC7-74	457.3	0.00727	0.000370
	NC7-74	496.5	0.00727	0.000320
	NC7-74	513.5	0.00718	0.000270
	PIT7-01	10	0.00579	0.000090
	PIT7-01	21.3	0.00699	0.000050
	PIT7-04	12.5	0.00458	0.000070
	PIT7-04	21	0.00294	0.000060
	PIT7-04	25.5	0.00709	0.000150

Table A-9. Summary of uranium-235/uranium-238 in subsurface soil (>0.5 ft bgs) at Site 300. (Cont. Page 2 of 3)

Operable unit (OU)	Sampling location	Sample depth range (ft bgs)	Result ^a	Error (+/-)
Building 850/Pits 3 & 5 (OU 5) (Cont.)	PIT7-05	12.5	0.00719	0.000220
	PIT7-05	18	0.00722	0.000080
	PIT7-06	14.3	0.00723	0.000100
	PIT7-06	23.5	0.00709	0.000155
	PIT7-07	10.5	0.00380	0.000060
	PIT7-07	20	0.00707	0.000013
	PIT7-08	15.5	0.00717	0.000170
	PIT7-09	10	0.00730	0.000110
	PIT7-09	15	0.00704	0.000080
	W-PIT7-02	10.9	0.00693	0.000140
	W-PIT7-02	18.3	0.00693	0.000060
	W-PIT7-02	31.3	0.00704	0.000100
	W-PIT7-02	35	0.00682	0.000080
	W-PIT7-02	41.3	0.00701	0.000100
	W-PIT7-02	43	0.00678	0.000070
	W-PIT7-03	10.5	0.00689	0.000120
	W-PIT7-03	36	0.00718	0.000120
	W-PIT7-10	12.8	0.00714	0.000115
	W-PIT7-10	31	0.00705	0.000150
	W-PIT7-10	41	0.00712	0.000100
	W-PIT7-10	47.5	0.00712	0.000130
Building 854 Area (OU 6)	W-854-01	0.5	0.00568	0.000170
	W-854-01	5	0.00717	0.000080
	W-854-01	10	0.00726	0.000080
	W-854-01	20	0.00757	0.000140

Table A-9. Summary of uranium-235/uranium-238 in subsurface soil (>0.5 ft bgs) at Site 300. (Cont. Page 3 of 3)

Operable unit (OU)	Sampling location	Sample depth range (ft bgs)	Result ^a	Error (+/-)
Building 845 (OU 8)	K9-02	142.5	0.00732	0.000300
	K9-02	146.5	0.00734	0.000270
	K9-02	156.5	0.00725	0.000240
	K9-02	167.5	0.00721	0.000280

Note:

ft bgs = Feet below ground surface.

^a Shading indicates values less than 0.007.

Table A-10. Summary of sampling events and occurrences of uranium-235/uranium-238 in ground water and springs at Site 300.

Operable Unit (OU)	Total number of analyses	Number of analyses less than 0.007	Total number of sampling locations (wells and springs) with analyses	Number of sampling locations (wells and springs) with analyses less than 0.007	Range of values	Range of average values
Building 834 (OU 2)	No data	No data	No data	No data	No data	No data
Pit 6 Area (OU 3)	3	0\	1	0	0.00729 - 0.00742	Not applicable
HE Process Area (OU 4)	17	0	6	0	0.00722 - 0.00751	0.00723 - 0.00737
Building 850/Pits 3 & 5 (OU 5)	287	119	66	28	0.00267 - 0.0078	0.0028 - 0.0078
Building 854 Area (OU 6)	8	1	8	1	0.00698 - 0.00816	Not applicable
Building 832 Canyon (OU 7)	2	0	2	0	0.00731 - 0.00738	Not applicable
OU 8	110	26	34	7	0.00415 - 0.0076	0.00530 - 0.00759
Totals	427	146	117	36		

Table A-11. Summary of uranium-235/uranium-238 in ground water and springs at Site 300.

Operable unit (OU)	Well ID	Average result ^a	Average error(+/-)	Number of analyses	Range of results ^a	
					Minimum	Maximum
Pit 6 (OU3)	K6-23	0.00736	0.000130	3	0.00729	0.00742
HEPA (OU4)	W-814-04	0.00723	0.000277	3	0.00722	0.00725
	W-818-01	0.00732	0.000076	5	0.00724	0.00738
	W-823-13	0.00733	0.000050	1	-	-
	W-827-03	0.00735	0.000213	3	0.00725	0.00751
	W-829-06	0.00737	0.000077	3	0.00733	0.00744
	W-829-08	0.00736	0.000075	2	0.00735	0.00737
Building 850/Pits 3&5 (OU5)	K7-01	0.00731	0.000092	5	0.00726	0.00741
	K7-03	0.00723	0.000063	4	0.00720	0.00729
	K7-06	0.00726	0.000135	4	0.00720	0.00732
	K7-09	0.00687	0.000435	2	0.00650	0.00724
	K7-10	0.00691	0.000110	1	-	-
	NC7-10	0.00714	0.000143	3	0.00702	0.00723
	NC7-11	0.00693	0.000103	3	0.00677	0.00703
	NC7-12	0.00731	0.000080	1	-	-
	NC7-14	0.00595	0.000220	1	-	-
	NC7-15	0.00714	0.000155	2	0.00712	0.00716
	NC7-16	0.00500	0.000068	8	0.00448	0.00537
	NC7-17	0.00724	0.000113	3	0.00714	0.00735
	NC7-18	0.00721	0.000107	7	0.00690	0.00741
	NC7-19	0.00728	0.000135	4	0.00705	0.00754
	NC7-20	0.00716	0.000104	8	0.00698	0.00727
	NC7-21	0.00729	0.000068	5	0.00719	0.00738
	NC7-24	0.00728	0.000100	2	0.00703	0.00752

Table A-11. Summary of uranium-235/uranium-238 in ground water and springs at Site 300. (Cont. Page 2 of 5)

Operable unit (OU)	Well ID	Average result ^a	Average error(+/-)	Number of analyses	Range of results ^a	
					Minimum	Maximum
Building 850/Pits 3&5 (OU5) (Cont.)	NC7-25	0.00730	0.000072	12	0.00712	0.00747
	NC7-26	0.00718	0.000515	10	0.00580	0.00752
	NC7-27	0.00726	0.000086	10	0.00707	0.00745
	NC7-28	0.00280	0.000068	12	0.00267	0.00310
	NC7-29	0.00732	0.000060	1	-	-
	NC7-34	0.00351	0.000058	13	0.00319	0.00385
	NC7-36	0.00711	0.000122	13	0.00696	0.00729
	NC7-37	0.00342	0.000040	5	0.00299	0.00368
	NC7-40	0.00361	0.000046	5	0.00348	0.00382
	NC7-43	0.00494	0.000076	7	0.00439	0.00525
	NC7-44	0.00727	0.000120	1	-	-
	NC7-45	0.00722	0.000076	5	0.00705	0.00732
	NC7-46	0.00702	0.000263	4	0.00632	0.00738
	NC7-47	0.00696	0.000120	1	-	-
	NC7-48	0.00300	0.000047	14	0.00267	0.00423
	NC7-49A	0.00723	0.000270	2	0.00712	0.00733
	NC7-51	0.00701	0.000090	2	0.00700	0.00702
	NC7-52	0.00722	0.000093	3	0.00716	0.00725
	NC7-52A	0.00744	0.000260	2	0.00724	0.00763
	NC7-53	0.00714	0.000215	4	0.00695	0.00730
	NC7-54	0.00579	0.000120	4	0.00524	0.00612
	NC7-56	0.00588	0.000070	2	0.00492	0.00683
	NC7-59	0.00726	0.000091	8	0.00701	0.00756
	NC7-60	0.00721	0.000195	2	0.00718	0.00723

Table A-11. Summary of uranium-235/uranium-238 in ground water and springs at Site 300. (Cont. Page 3 of 5)

Operable unit (OU)	Well ID	Average result ^a	Average error(+/-)	Number of analyses	Range of results ^a	
					Minimum	Maximum
Building 850/Pits 3&5 (OU5) (Cont.)	NC7-61	0.00508	0.000072	9	0.00494	0.00525
	NC7-62	0.00731	0.000083	4	0.00723	0.00739
	NC7-64	0.00636	0.000064	8	0.00550	0.00729
	NC7-65	0.00700	0.000350	1	-	-
	NC7-67	0.00780	0.001000	1	-	-
	NC7-68	0.00726	0.000140	3	0.00721	0.00735
	NC7-70	0.00625	0.000184	10	0.00560	0.00687
	NC7-71	0.00710	0.000925	2	0.00699	0.00720
	NC7-75	0.00699	0.000249	11	0.00629	0.00735
	NC7-76	0.00735	0.000090	1	-	-
	W-850-05	0.00694	0.000276	7	0.00674	0.00709
	W-PIT7-02	0.00723	0.000185	8	0.00698	0.00750
	W-PIT7-03	0.00692	0.000077	7	0.00639	0.00724
	W-PIT7-10	0.00724	0.000119	8	0.00707	0.00744
	W8SPRNG	0.00667	0.000109	8	0.00377	0.00722
Building 854 (OU6)	W-854-01	0.00723	0.000080	1	-	-
	W-854-02	0.00750	0.000120	1	-	-
	W-854-04	0.00816	0.000390	1	-	-
	W-854-05	0.00698	0.000060	1	-	-
	W-854-08	0.00755	0.000080	1	-	-
	W-854-10	0.00735	0.000070	1	-	-
	W-854-11	0.00728	0.000070	1	-	-
	WELL13	0.00733	0.000120	1	-	-

Table A-11. Summary of uranium-235/uranium-238 in ground water and springs at Site 300. (Cont. Page 4 of 5)

Operable unit (OU)	Well ID	Average result ^a	Average error(+/-)	Number of analyses	Range of results ^a	
					Minimum	Maximum
Building 832 Canyon (OU7)	SPRING3	0.00731	0.000110	1	-	-
	W-830-17	0.00738	0.000070	1	-	-
Building 801 (OU8)	K8-01	0.00728	0.000123	6	0.00716	0.00739
	K8-02B	0.00728	0.000071	9	0.00704	0.00741
	K8-03B	0.00727	0.000084	8	0.00710	0.00745
Building 802 (OU8)	NC2-06	0.00728	0.000230	1	-	-
	NC2-09	0.00746	0.000620	1	-	-
	NC2-10	0.00725	0.000155	2	0.00719	0.00730
	NC2-11I	0.00733	0.000140	1	-	-
	NC2-12I	0.00719	0.000130	1	-	-
	NC2-13	0.00728	0.000150	1	-	-
	NC2-17	0.00725	0.000080	1	-	-
	NC2-19	0.00734	0.000055	2	0.00732	0.00736
	WELL01	0.00724	0.000110	1	-	-
Building 812 (OU8)	NC2-22	0.00737	0.000120	4	0.00727	0.00755
	NC2-23	0.00729	0.000135	4	0.00719	0.00743
	SPRING6	0.00670	0.000078	8	0.00616	0.00717
Building 845 (OU8)	K9-03	0.00722	0.000233	6	0.00709	0.00739
	K9-04	0.00719	0.000220	1	-	-
Building 851 (OU8)	W-851-05	0.00695	0.000348	5	0.00644	0.00728
	W-851-06	0.00593	0.000260	7	0.00340	0.00690
	W-851-07	0.00722	0.000258	6	0.00687	0.00760
	W-851-08	0.00530	0.000092	5	0.00415	0.00587

Table A-11. Summary of uranium-235/uranium-238 in ground water and springs at Site 300. (Cont. Page 5 of 5)

Operable unit (OU)	Well ID	Average result ^a	Average error(+/-)	Number of analyses	Range of results ^a	
					Minimum	Maximum
Other (OU8)	K1-01C	0.00731	0.000110	3	0.00718	0.00737
	K1-02B	0.00732	0.000197	3	0.00725	0.00744
	K1-06	0.00759	0.000050	1	-	-
	K2-01C	0.00685	0.000100	1	-	-
	K2-03	0.00735	0.000080	2	0.00732	0.00737
	NC2-07	0.00732	0.000123	3	0.00731	0.00734
	K2-04D	0.00734	0.000190	1	-	-
	K2-04S	0.00730	0.000112	5	0.00722	0.00736
	NC2-08	0.00732	0.000180	1	-	-
	NC2-14S	0.00729	0.000280	1	-	-
	NC2-15	0.00724	0.000160	1	-	-
	NC2-16	0.00731	0.000170	1	-	-
	NC2-18	0.00722	0.000180	1	-	-

^a Shading indicates values less than 0.007